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Generally Speaking

We are always interested to hear of any new developments in the use of industrial diamonds, either in the way of new tools, or of new ways of using them, and we are following our recent article on some of the professional glass engravers with a report next month on the work of an amateur, the Reverend Vivian Symons, Vicar of Biggin Hill in Kent. This enterprising gentleman has succeeded in doing almost all the artistic work necessary for finishing a new church himself, including the provision of engraved glass windows.

Education

Whilst our last month's issue was still at the printers, we were visited by a leading American manufacturer of diamond tools who came especially with the intention of emphasizing the very point that we had made in that article: that users, and particularly new users of the diamond tool, need to be educated in the best ways of making use of this equipment, and have to have it demonstrated to them that the apparent expense of such tools is always more than counterbalanced by the economy that may be achieved by their use.

Industrial Diamonds in Electronics

It seems quite probable that in future the use of diamond tools and diamond powder for cutting and lapping the crystals used in transistors, quartz frequency controllers, silicon diodes, and in all the other present and future applications for the crystals to electronics, may well prove to be one of the most important applications of diamond. The techniques, such as those described in the article by Z. Ministr, started in last month's issue and concluded in this, are frequently applicable for those purposes, and in many cases nothing but diamond will serve to produce the extreme accuracy necessary.

ADAMANT

The Italian Machine Tool Exhibition

Milan, September 11th to 21, 1958.

The Italian machine tool industry has for many years been able to design and manufacture excellent examples of this type of equipment, but it has only been in the post-war period that the output has been sufficient to supply more than a small part of the needs of the country's industry. Recently, and especially during the last four years, the situation has been different, and, although Italy still imports a considerable number of machine tools, this number is being reduced, and at the same time a considerable export market has been found for Italian machines both in Europe and the Americas. Since 1954, the total production of Italian machine tools has risen by 40%, while the exports of this type of equipment have risen by 76%. These figures form the background to the first exhibition in Italy solely devoted to machine tools and their accessories, which has just taken place in the grounds of the Milan Fair, organized by the UCIMU (Unione Costruttori Italiani Macchine Utensili). Although a few machines of non-Italian origin were shown by firms holding agencies, the great majority of the exhibits was of Italian design and manufacture, and both the individual exhibits and the exhibition as a whole reflected great credit on the organizers and on the industry they represent.

The Italian Government is fully appreciative of the importance of this industry to the country's economy, and the opening ceremony was delayed until the afternoon of September 11th to allow the Minister of Industry, the Hon. Giorgio Bo, who had been attending a conference in Geneva, to perform it himself, and in his opening speech he gave full credit to the industry for the way in which it had taken the opportunities it had so far had, and stressed the need for it to continue its efforts in the new conditions that will be imposed by the European Common Market.

Exhibition Layout

Five of the halls of the permanent exhibition ground were used for this exhibition, and were allocated as follows:

No 1: lathes, gear cutting machines, etc
No 2: tools and accessories
No 3: casting, die casting, and miscellaneous machines
No 4: grinding, drilling, and planing machines; presses, guillotines
No 5: measuring equipment, control equipment, automation equipment, electrical and electronic equipment.

Of necessity, there was a certain amount of over-lapping between the different divisions; for example, many of the heavy machine tools in Pavilion No 4 were fitted with the control or metering equipment shown separately in No 5, and similarly, the tools and accessories in No 2 were also to be seen mounted on the machines in No 1 and No 4.

Grinding machines

An outstanding feature of the machines in general was the good industrial design, with the consequent reduction in accident risk, and improvement in ease of cleaning. There has been a great advance in this matter in all countries during recent years, but the Italian designers seem to have been particularly successful in avoiding unnecessary 'bits and pieces' and in keeping good clean lines.

An excellent range of small grinding machines was shown by the Brescia firm of Fratelli Lizzini, including several universal tool grinders and hydraulically controlled precision grinders, and the specialized TRISCOP grinder, designed for the reconditioning of diesel engine injectors.

This machine, which uses diamond impregnated wheels, is equipped to carry out all the processes necessary for the complete reconditioning of diesel injectors, and can be fitted with special accessories to suit it for use on any make of injector available. To ensure accuracy and to reduce angular displacement to a minimum, an optical system that enables adjustments to be made to an accuracy of better than ± 5' of angle is fitted, and a micrometer adjustment controls the feed.

Another firm with a wide range of machines on show, in this case heavy duty grinding machines, is that of Gaetano Zocca of Como. The largest of these machines can take work of up to 5 metres length by 59 cm diameter (16 ft. 5 in. × 1ft. 11 in.). The feeds are all hydraulically

or manually driven, and can be coupled to electronic or pneumatic gauging devices for automatic control. This firm recommends the use of diamond dressing tools made by the English firm of L. M. Van Moppes with its machines.

Centreless grinders were shown by the Monza firm of Officine Meccaniche Monzesi, by Giustina of Turin and many others. Like the heavy duty grinders, these are all prepared for automatic control, and in many cases the manufacturers themselves supply the gauging and control equipment.

Special equipment for i.c. engines

One firm in particular—Bertoni and Cotti of Milan, has specialized in equipment for the manufacture and repair of motor vehicles, both petrol and diesel engined types. Amongst other machines, they have a series of crankshaft grinders, capable of dealing with even the largest crankshafts—up to 13 feet long, and with a throw of as much as 9 inches. As well as these machines, the same company manufactures special machines for working connecting rods, and main bearings, for valves and valve seats, for pistons and cylinder regrinding, and for brake drum truing. At the opposite end of the scale from the crankshaft grinders already mentioned, is a small electric valve seat grinder, fully portable for hand-held operation, and supplied complete with a special jig in which it can be mounted for diamond-truing the abrasive wheels. In addition to this specialized range, Bertoni and Cotti make universal and centreless grinders and other general machine tools and attachments.

Surface grinders

ALPA—Officine Giuseppe Albani, of Pavia—produce a number of types of surface grinder, ranging from the small, manually controlled bench model, with a maximum working surface of 150 mm × 300 mm (5.9 in. × 11.8 in.) to the large Mod. RT 1000 with a working surface of 1,000 mm × 370 mm (39.4 in. × 14.5 in.). Amongst the standard equipment for each of these machines is a mount for the diamond truing tool.

In the field of medium universal grinders, the firm of Famir of Turin, whose products are marketed through Bacco & Co, also of Turin, have produced a notable series of machines of good design and sound construction, that can be especially commended for the neatness and simplicity of the layout of their controls.

The well-known manufacturing company of Olivetti, of Ivrea, have developed a series of modular grinding machines, in which standardized sub-assemblies can be mounted in different combinations to produce a wide variety of machines without unduly increasing the number of basic parts. This system is both flexible and economical, and has special advantages for the manufacturer who is frequently faced by problems of short runs, and it is equally suitable for the long run production of some unusual item that might otherwise require a specially-designed machine. One of the built-in accessories on these machines is a wheel-forming fixture fitted for quick change templates for the control of the diamond forming tool. Both manually and hydraulically controlled diamond mounts are available.

Lizzini's TRISCOP diesel fuel injector grinder : this special purpose grinder is fitted with optical gauging devices to ensure a high degree of accuracy.

An Alpa surface grinder.

Diamond tools

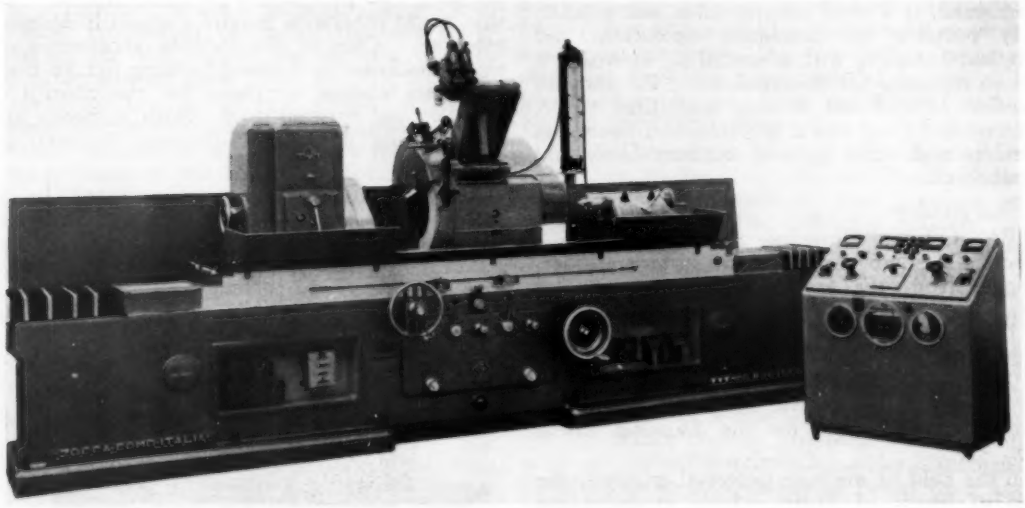
Diamond tools of all types, by a number of British and other manufacturers, were on show on agents' stands; as well as this there was a stand showing a complete range of the Diamant Boart production, put on by the Italian affiliated company, Diamant Boart Italiana. Another firm specializing in diamond tools is U.R.M.A. (Utensili Ravvivatori Mole Abrasive) of Turin, who were showing, amongst a wide selection of diamond tools, their patented cylindrical dressing tool, the 'Rolette,' which is claimed to have a number of advantages in use, especially as regards economy of time and material in dressing abrasive wheels.

Conclusion

The Italian trade press and the technical organizations were well represented at the Exhibition, which was conveniently arranged and well laid out. The impression gained was that of a healthy and expanding industry, which may well, in the conditions created by the establishment of the European Common Market, be able to extend its activities considerably. It remains to be seen what effect those same conditions will have on the British machine tool and general engineering industry.

A Universal grinding machine from the Famir stand, which has a characteristically neat layout for the controls.

One of the largest of the Zocca heavy-duty grinding machines.



X-RAY ORIENTATION OF DIAMONDS FOR DIAMOND TOOLS

A booklet of the above title has recently been published by the Diamond Research Laboratory, Johannesburg. The very latest developments in x-ray orientation are described, and the applications of the orientation process are dealt with. A limited number of copies is available, *gratis*, and those interested are advised to apply quickly whilst copies are available.

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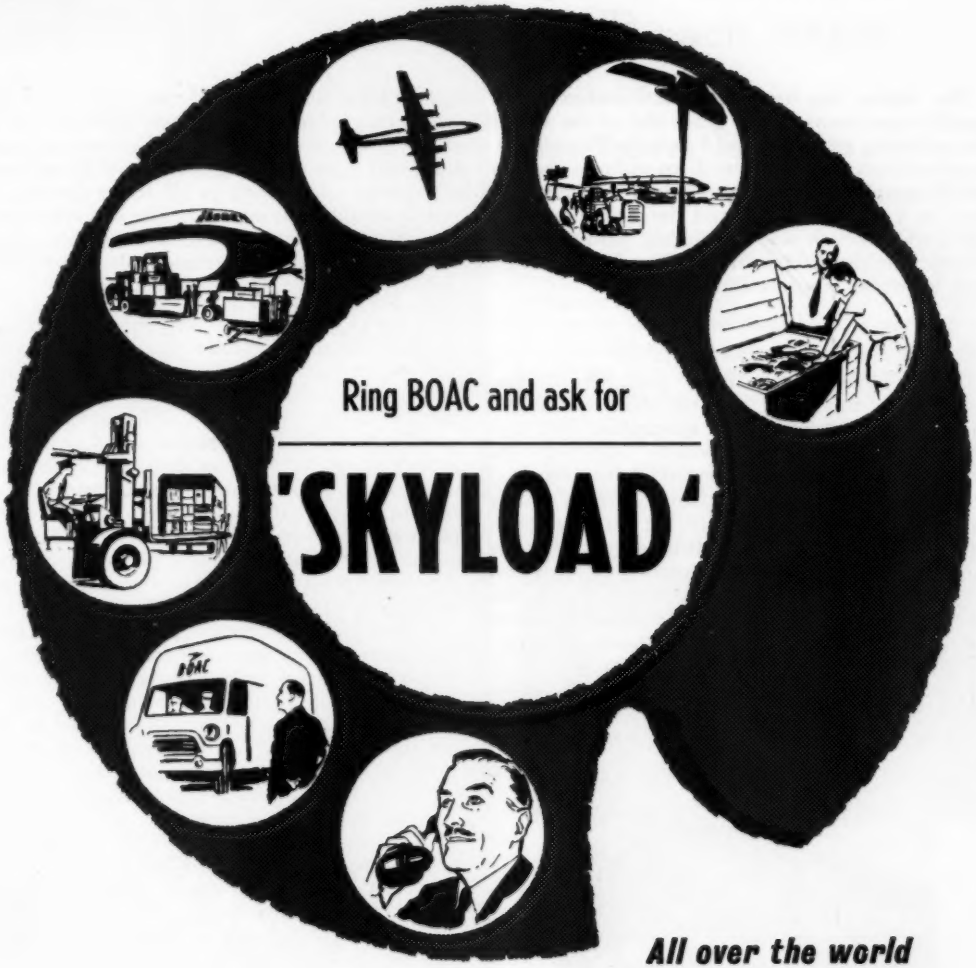

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Semi-Automatic Grinding of Metallographic Specimens of Very Hard Materials

by Z. Ministr

(Translated by E. Sudek)

Summary

The author has used very hard materials, *ie* boron carbide and diamond, for polishing metallographic specimens. The grain size of the abrasive has been graded very evenly in order to complete the polishing as quickly and as economically as possible. Boron carbide was dispersed in paraffin on a cast iron disk, and the diamond was used as a paste on paper covering the disk of a single-wheel metallographic polishing machine. Twelve plastics mounts, containing in all 48 specimens, were fixed in a special holder and the polishing completed in about 50 minutes. The surface obtained was quite smooth and absolutely plane. Semi-automatic polishing as described in this article is suitable for the preparation of a considerable number of specimens simultaneously, provided that their hardness is approximately equal.

Concluded from p 170

Automatic and semi-automatic grinding

Efforts have already been made by several workers in this field to introduce automatic grinding of metallographic specimens, but this method has not been widely adopted. Its advantages and disadvantages have been evaluated by R. Pusch.[2] The best known and most widely used equipment (shown in Fig 9) has been described by G. L. Kehl[15]. It is obvious that for a number of specimens the required finish stated can only be achieved in cases where all the specimens have very much the same hardness and surface area. It is difficult to say, however, why automatic grinding in metallography has not been much used until recently, whilst the automatic grinding of optical glasses has been common practice for a long time. The reason for this may be in the different processes involved. In glass grinding the predominating movement of the abrasive particles is rotary, so that in fact the grains are drilling small circular cavities into the surface being ground. The surface appears evenly pitted and opaque, and no parallel scratches can be seen, as opposed to the case of the normal grinding of a metallic surface which remains bright and glittering with the abrasive particles following a linear motion. Equipment suitable for grinding glass is generally useless for grinding metals, since abrasive particles would bed themselves into palleable metal or would chip out particles from a brittle one. This can be shown by grinding a soft transparent mounting metal with dark boron carbide in such a manner that the holding device with the mounted specimens (shown in Fig 3) is allowed to rotate quickly. In this way the rotary motion of the abrasive particles predominates over the linear motion, and if we look through a powerful lens at a mounted specimen ground in this way, we can see the dark abrasive particles bedded into the surface, but if the mounted specimen is held stationary for a short time on a lapping wheel, the surface layer with the bedded-in particles is ground off, and the mount becomes transparent again.

Fig 9. Kehl's automatic metallographic polishing machine.

It can be seen from this that particles in automatic grinding must have a linear motion, so as to form parallel scratches on the specimen. This can be done easily by arranging the holding device with the mounted specimens so that it remains stationary on the surface of the rotating wheel as shown in Fig 10a. The principal disadvantages of this simple arrangement would be that the grinding wheel would be worn in a narrow circular band. In order to avoid this, the holding device should be placed off centre or

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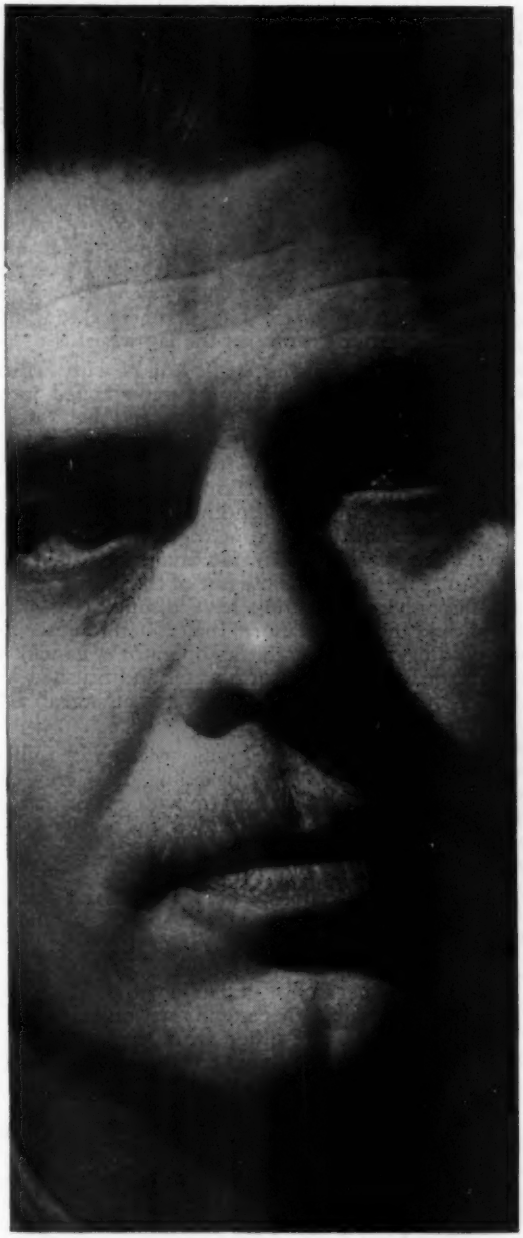
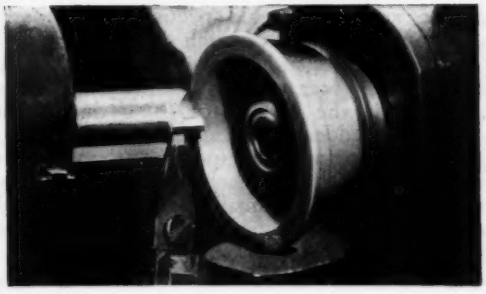


"We get more jobs out of each wheel with these" says **Tom Swain**

Tom Swain is the charge-hand of the cutter-grinding shop of Jonas & Colver (Tools) Limited. Most of the tools they grind there go to the motor industry or the aircraft industry. Among the most successful production tools that Tom's men use are the resin-bonded diamond wheels made by CARBORUNDUM shown in our smaller illustration. 'We find we get more jobs out of each wheel with these.' Tom says, 'And that's important with diamond wheels. Diamonds cost money!' He might have added that long wheel-life saves time spent in wheel changing, and so increases the production rate — not a big increase, but worth something in the course of a year.



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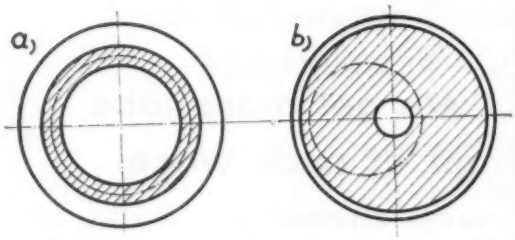
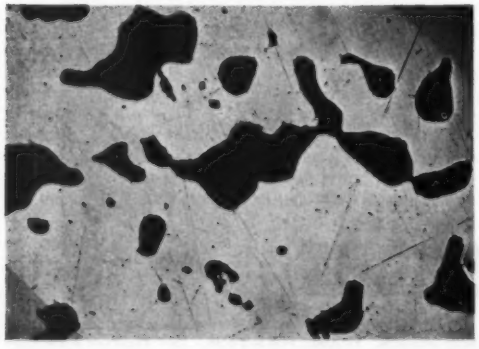


Fig 10 (a). Groove worn in lap by stationary specimen holder. (b) Rotating specimen holder covers almost whole surface of lap.

the grinding wheel. The grinding area is then worn almost evenly over the whole surface as shown in Fig 10b. With this arrangement it is necessary that the holding device should rotate very slowly so that the mounted specimens continually change their position. This is done very simply by restraining the holding device by holding the wheel in the left hand. Because this is done manually, this type of grinding is called semi-automatic rather than automatic. If the holding device were not slowed down in this way, it would rotate almost as quickly as the lapping wheel, and in this case the rotary motion of the abrasive particles would predominate over the linear motion, and bedding-in of particles in the surface of the specimen would occur. Two possible unfortunate results of such bedding-in are (a) that the particles so bedded-in might be loosened during later fine grinding, so causing serious scratches in the surface, or (b) if the particles remain embedded in the specimen, they may be mistaken during examination for structural ingredients. This can happen with porous materials, and such small sharp edged particles do, in fact, sometimes occur as structural ingredients. Fig 11 shows a polished specimen of a cast permanent magnet (Alni), having in one

Fig 11. Abrasive grain bedded into an Alni magnet in rough grinding.



pore an abrasive grain which bedded itself into the specimen during rough grinding. Fig 12 shows a sintered permanent magnet of the same material, but in this case a sharp edged grain is actually a structural ingredient—an impurity included in the metal powder. A skilled observer would be able to distinguish between these two cases with certainty, and although the examples given clearly demonstrate the possibility of such a difficulty, in fact, where the grinding and polishing is carried out in the correct manner, it seldom arises, even with porous materials. One of the precautions to be taken is to ensure that the pitch circle of the holding device does not overlap the centre of the lap wheel.

When grinding on the disk with silicon carbide, a small amount of water is fed into a groove in the holding device, and led through small holes to each mounted specimen. The water is carried away from the lapping wheel by centrifugal force, taking with it the ground off material. The grinding operation is interrupted from time to time for examination of the surface of the specimens, and is considered as complete as soon as the last of the scratches from the previous grinding have disappeared, which should not take more than 10 minutes. The holding device (and the operator's hands) are washed in running warm water and brushed with a soft brush to remove any remaining abrasive particles.

Grinding on the lapping wheel with silicon carbide is followed by grinding on a grey cast-iron lapping wheel charged with boron carbide of 320 mesh size suspended in paraffin. The lapping wheel is charged with this suspension as required with a brush. The finer grade of abrasive powder (to 10 microns) for the succeeding grinding stage is obtained by recrushing the 320 mesh powder and regrading it by sedimentation in paraffin. Recrushing is carried out in a ball mill either dry or in paraffin, and the mill and balls are washed in paraffin after crushing. The thin suspension resulting from this (20 - 25 g of abrasive in 1 litre of paraffin) is then left to settle in a glass vessel allowing a depth of about 20 cm. The suspension is stirred and left to settle for 10 minutes before pouring off. The residue (sink) contains particles of 10 to 40 microns, whilst the liquid poured off contains particles of less than 10 microns. After further standing for a prolonged period, the pure paraffin can be poured off leaving a residue of concentrated suspension.

For medium grinding of very hard materials a grey cast-iron wheel is most suitable, as the abrasive particles are pressed in or fixed in those parts where there are graphite flakes. White

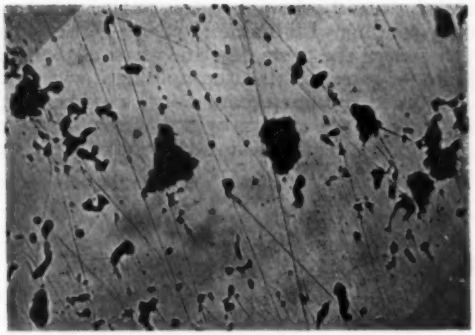


Fig 12. Sharp-edged grain forming a constituent of sintered Alni.

cast-iron is not suitable, because the abrasive particles roll on the surface of the wheel and the specimen looks as if it has been sandblasted. Wheels with layers of soft alloys (Pb/Sn) are not suitable, because the abrasive particles become completely embedded in the layer.

After finishing the grinding with 10 micron boron carbide, the specimens are ground with diamond powder in a paste spread on paper which is clamped to the wheel. The diamond powder is in the form of sharp-edged plate-shaped particles, the natural result of crushing the diamonds, owing to the easy cleavage in the octahedral planes. The majority of these particles adhere to the support by their larger surfaces and act as small planers. The result is that scratches are not produced, and the surface becomes smooth. At the same time, with some materials pressure develops between the plate-like surfaces of the particles and asperities on the surface of the specimen, so producing some degree of smoothing by plastic deformation. This is an undesirable effect, because it results in the formation of a work-hardened layer on the surface with a structure differing from that of the specimen. However, it is very unlikely that such an effect would be produced when grinding very hard materials, such as metal carbides. Polishing with the softer, plate-shaped alumina (gamma modification), which was recommended formerly, is of no value, and diamond is the only suitable material and cannot be replaced.

Scratches will occasionally appear here and there on the surface whilst grinding with diamond. Some of these will be seen to disappear, only to reappear in a different place. Such scratches are caused by abrasive particles having momentarily turned on edge. However, if a number of deep scratches is continually formed during grinding, it is normally caused by contamination of the diamond paste by particles coarser than 3 microns. When the polishing has been performed correctly, the surface of the specimens, after grinding with 3 micron diamond powder, is usually so smooth that it can be considered as polished. If this is not the case, a sixth stage of very fine grinding can be used, but this is only effective when the scratches on the specimen are due to diamond particles of a size not greater than 3 microns, as it is impossible to remove coarser scratches by such very fine grinding. After very fine grinding with 1 micron diamond powder, the surface should be perfectly smooth, and such scratches as there are are hardly noticeable since their width is generally less than the resolving power of an optical microscope. When scratches of a greater width than 1 micron occur during very fine grinding, these are caused by contamination of the paste with coarser particles.

When grinding with a paste spread on paper, the coarser grains are pressed into the paper and continually scratch the surface of the specimen. When a harder support is used, the coarser grains may be recrushed during grinding. In general, the rule that the abrasive support must be softer than the material to be ground holds good, in order that the particles should be partly pressed into the support by the grinding pressure. The finer the abrasive, and the softer the specimen, the smaller the pressure need be. A paper support has the advantage that it can be used for grinding both hard and soft materials, and the paste will adhere to it well so that losses from centrifugal force are negligible. The disadvantages are that the paper is poor in strength, poor in resistance to wear, and difficult to keep tightly stretched. Fine imitation chamois fabrics (Selvyt, etc) are therefore often preferred to paper[4]. Other authors have recommended wheels of grey cast-iron or plastics for fine grinding of hard materials (diamonds and very hard metals). There is a further advantage in using such wheels, in that a perfectly flat ground surface is obtained, which is not the case on fabric. The specimens shown in the illustrations to this paper were ground on a paper support.

Grinding with diamond paste on paper

For the preparation of the paste described by Samuels, 0.5 g of diamond abrasive, 12.5 g of stearic acid, 6 ml triethanolamine, and 25 ml of water is used. The stearic acid is fused at between 80 and 90 deg C. The triethanolamine is mixed with the greater part of the water and heated to the same temperature. The previously wetted abrasive is added to this solution and stirred. This suspension is then poured quickly into the fused stearic acid and constantly stirred. The paste begins to thicken immediately, but

stirring should continue until it has cooled down and completely thickened. The water remaining should be used for washing off the abrasive remaining on the walls of the vessel.

About 1 to 2 cc of paste (containing about 0.01 to 0.02 g of diamond abrasive) is spread on a new paper cover and forms an even film on the paper during grinding. If the film is too thick, the grinding takes longer and the paste collects along the edges of the specimens. If the paste on the wheel becomes dry and stiff, it can be thinned by dropping a little paraffin from time to time on the wheel, but care must be taken not to thin the paste to such an extent that it is carried away from the wheel by centrifugal force. A test for the correct consistency of the paste is to hold the specimen by hand. The dragging power should be such that the specimen can be held without having to support the hand on the table. If the paste is too stiff, so that a greater force is necessary to hold the specimen, the paper support will be stressed too much, will become crumpled, and will wear off or tear. From this it follows that for semi-automatic grinding with diamond abrasive, some skill and 'feel' in holding the specimen must be acquired.

For fast and efficacious grinding it is necessary that the specimens should have rounded edges to avoid collection of the paste along them. It is also important that the mounting material should be free from cavities in which coarser abrasive particles from preceding stages of grinding would remain, only to be loosened during grinding with diamond paste. One of the advantages of the paste described here is that it is soluble in water, so that the holding device with the mounted specimens can easily be washed with a soft brush in a stream of hot water. Further details are given in the author's book 'Practical Metallographic Microscopy'[16].

References:

1 G. Z. Nesselstraus, *Zavods Lab* 1947 Vol 13 p 1326
2 R. Pusch, *Stahl & Eisen* 1955 Vol 75 (6) pp 335-345
3 Published by Buehler Ltd
4 L. E. Samuels, *Journal of Metals* 1953 Vol 81 (10) pp 471-478
5 R. Kieffer and P. Schwarzkopf, Hartstoffe und Hartmetalle, Springer Verlag, Vienna. 1953, p 34
6 H. Bottone (mentioned by Kieffer and Schwarzkopf (5), p 32)
7 Metallography of sintered carbides; from the Proc *Progress in Powder Metallurgy*, CSAV, Prague, 1954 p 78; see also the paper J. Flasar and D. Friedl, *Hutnicke listy* 1953 Vol 8 (5) pp 246-249
9 M. Pirani, K. Schroeter, *Zeits Metallkunde* 1924 Vol 16 (4) p 132
10 K. Schroeter, *Zeits Metallkunde* 1928 Vol 20 (1)
11 N. M. Zarubin, *Zavods Lab* 1948 (12) pp 1434-1436
12 R. Silverman and P. D. Lusca, *Powder Metallurgy Bull* Vol 7 (1) pp 25-28
13 E. Bryjak, *Hutnik* 1951 Vol 18 (1) pp 14-24
14 G. R. Blecker, *Iron Age* 1950 Vol 165 (21) pp 71-74
15 G. L. Kehl, Principles of Metallographic Laboratory Practice, New York. 1949.
16 Z. Ministr, Practical Metallographic Microscopy, SNTL, Prague. 1956

Reprinted by permission from Hutnické listy 1956 Vol 11 (3) pp 154-160 Powder Metallurgy Research Institute, Vestec, near Prague.

Indexing truing device

The Unidex indexing holder, introduced earlier this year by the Universal Diamond Company Limited, is designed to obtain maximum efficiency from the truing diamond by exploiting its natural octahedral structure.

Fig 1 shows the Unidex device mounted in the toolpost for its first truing operation; the shank is marked with a gold spot which should be in position 1 at the start of its life. When a flat is worn along line A1, Fig 2, the knurled nut is released and the diamond head is indexed 90 deg to present cutting point 1 to the wheel. This process can be repeated through 360°, *ie* until cutting point 2 of flat B2 is in the truing position. Indexing can continue in this manner until the worn planes reach the matrix on all four positions; Fig 3 illustrates the four new cutting edges which will then appear between each pair of worn planes. By turning the whole tool in the toolpost to position 2, Fig 4, the diamond can again be indexed through 360°

Fig 1. Unidex (shown in closed toolpost) ready for first truing operation.

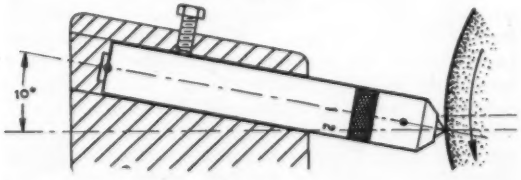


Fig 2. Planes and points produced by wear of diamond.

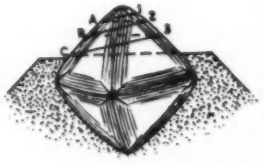
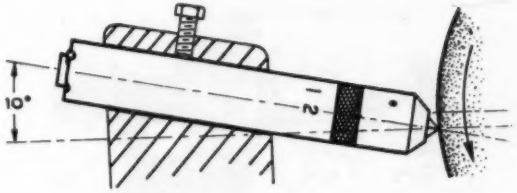


Fig 3. Cutting edges formed by wear of planes.

Fig 4. Unidex (shown in open toolpost) in position 2 for final use before resetting of diamond.



until the matrix is reached, at which stage the tool should be returned to the manufacturers for resetting.

The Unidex truing device can be obtained with a variety of shanks suitable for open, closed, or tapered toolposts.

An Accurate Attachment for Forming Grinding Wheel Contours

An attachment for grinding machines, capable of great accuracy in the formation of wheel contours, either convex or concave, has been produced by the Threadwell Tap and Die Co., of Greenfield, Mass., U.S.A., under the name of Tangi-Matic. It is claimed that no more skill is needed to set up and operate this device than is needed for the use of an ordinary micrometer.

By carrying out the form-truing process at the working point of the wheel—in the case of the surface grinders for which this equipment is primarily intended, at the bottom of the wheel—any errors that might arise in machines where the chuck is not exactly true with the spindle are avoided. The device can be used either right- or left-handed, to suit clockwise or counter-clockwise rotation, and in either case the abrasive debris from the wheel is thrown away from the truer, reducing the risk of damage to the equipment. The design has been arranged to make cleaning as easy as possible, and most parts can be blown clean with an air jet. The equipment can be used, without removing the wheel guard, on wheels of up to 10 inches diameter with a standard arm, or of up to 20 inches with an extension.

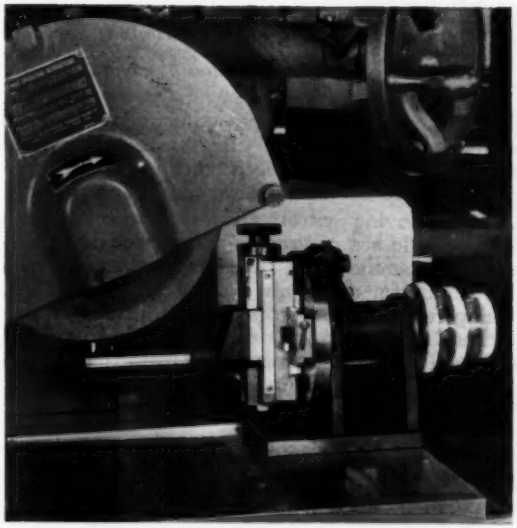


Fig 1. The Tangi-Matic attachment set-up in position on the magnetic chuck of a grinding machine.

The unit is completely self-contained, with its own direct-reading scales, and no external measuring instruments are needed. Once the diamond has been zeroed against the master setting block, all settings are made by the direct-

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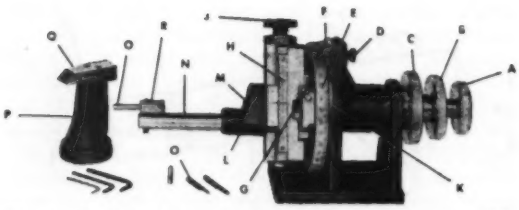


Fig 2. Detailed view of Tangi-Matic: A Cross slide actuating knob for dressing tangents; B Spindle actuating knob for dressing radial forms; C Spindle lock; D Radius stop pin; E Tangent angle scale in degrees; F. Tangent angle vernier reading to minutes; G Positive centre release lever (one on each side); H Radius control scale — .050 in. graduations; J Radius control knob — .001 in. graduations; K Arc limit dogs; L Dressing arm lock; M Dressing arm mount lock; N Dressing arm; O Diamond tool; P Master setting gauge; Q Flush pin setting gauge; and R Small radius diamond adapter.

reading micrometer type adjustment for the desired radius, and the direct reading dial and vernier for angle. Tangent settings are marked in degrees and minutes for accuracy.

The moving parts and slideways of the Tangi-Matic are of ground and lapped hardened steel, whilst the main structural elements are of Meehanite for maximum rigidity. The maximum truing radius, either convex or concave, is two inches; the minimum depends on the diamond used. The tangent length, determined by cross slide travel, is five inches. The device itself imposes no limit on the width of wheel that can be trued.

Using the Tangi-Matic

Figure 1 shows the truer in position on the chuck of a surface grinder. Figure 2 shows the arrangement and use of the various parts. The operation is simple, and can be carried out quickly and accurately by any reasonably skilled operator. The truing diamond point is first of all zeroed against the setting block, with the radius scale and the radius control knob set to zero, and the tangent scale at 90°. The diamond is then brought to exact centre with the tangent scale at zero. All tangent angles and curve radii are then set up on the scales from this reference point.

Radii are set up by adjusting the radius control knob, taking the reading on the radius control scale and the supplementary scale on the knob. Convex radii are set below the zero on the scale, and concave radii above it. Limiting stops may be set to define the limits of the arc dressed.

The tangent angles are set by rotating the tangent angle disk to the required setting, reading degrees on the main scale, and minutes on the vernier. The equipment is now set up and ready for use, with a considerable saving in time when compared with devices that necessitate the use of external instruments.

A Four Facet Diamond Truer

by John Waller

Introduction

In many workshops, especially where toolmaking is undertaken, a single diamond truer meets the needs of several surface grinders, and in production shops there are many occasions when a series of these accessories distributed among several operators gradually becomes so worn that eventually only one remains which is serviceable; a hurried visit of the complete batch to a tool fitter for the re-setting of the diamonds is then essential in an effort to avoid possible delays in production.

With these circumstances in mind—and they do occur more often than is apparent by a casual observation of the grinding section—the provision of a four facet diamond truer is a useful asset, because, though it does not eliminate 'working a dresser to death' before having it re-set, a great increase in the life between visits to the tool fitter is soon noticed. The single truer in the toolroom is thus expected to operate for a year without complaints, and, with this in mind, the truer described here is worth the few hours spent in constructional time, and is preferable in all respects to the normal type of square block favoured by a number of grinding sections.

Construction

The idea is simple, and, as the drawing illustrates, it consists of a square piece of steel shaped to the form of a pyramid, so that each side performs the duty of a seating surface on which the device will stand, when in service, on the magnetic chuck of the grinding machine. A piece of this material about 4 to 5 in. square, or an odd circular end cut from a bar, is often found lying around the workshop and represents scrap material, but for jobs of this nature it serves a useful purpose.

Dimensional accuracy is unimportant for the shaping of the base—other than to obtain some

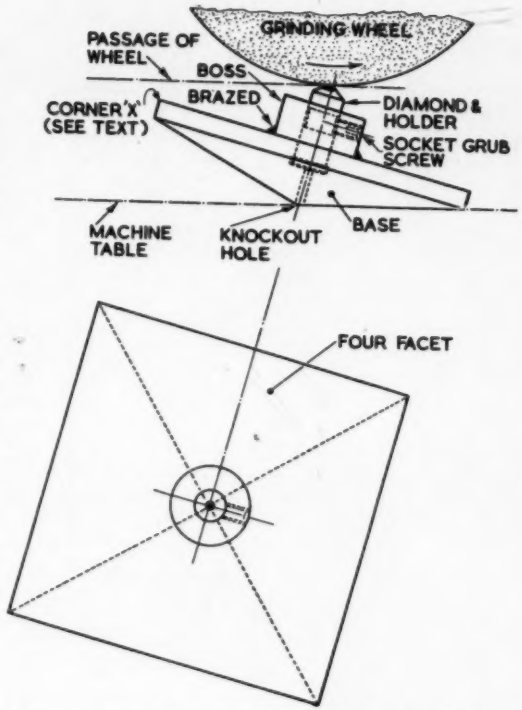
degree of uniformity about the facets in order to preserve a good appearance—a brief marking out process to indicate where each cut commences on the edge of the block, together with the centre point, is all that is necessary as a guide to the machinist. Either a shaping machine or miller will remove the unwanted material from the block—the former machine tool is probably the best method to use, especially if a universal vice is available, because this means that each face is cut at a single setting after square forming the outside of the detail.

The drawing shows a boss on one side of the block in which the diamond dresser is fitted, and there is also the suggestion that brazing be attempted as a means of holding this part to the larger detail. Brazing is only necessary when the original piece of material from which the base is shaped is not large enough to accommodate this boss—a circular boss is shown on the drawing as this type of material is more readily available in the workshop—but in the event of the boss being machined solid with the base, a square boss will give identical results. There is, however, one awkward operation with a boss machined integral with the base: the drilling and tapping of the small hole for the socket grub screw is not so easy to carry out as when the work is accomplished on the circular member.

An alternative way of removing the surplus metal round the boss, when the latter is made as solid with the base, is to set the block in a four jaw chuck prior to the shaping process, and to turn away the excess material at the same setting as the drilling and boring of the central hole. Brazing produces excellent articles of this type, and the two pieces secured in this manner are as strong as the solid detail.

Arrangement of diamond

Whether any surface grinding is carried out to remove the marks left by the shaping machine tool or milling cutter is immaterial—most machinists on a grinding machine will, no doubt, prefer to finish off the accessory in this way to ensure a perfectly flat surface on which to rest the truer, but other than this there is no point in



Simplicity is the keynote of this design of truer, but with each facet serving as a base on which to stand the accessory, a considerable increase in the time between re-settings of the diamond is obtained. Made from scrap pieces of material, the cost is merely the three or four hours machining time necessary for the shaping of the base member.

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achieving a high degree of finish or close accuracy. Incidentally, each facet angle is 15° producing a top pyramid angle of 150°, and there is really only one item to watch during the machining of this base—the top corner at 'X' must never protrude above the diamond, otherwise the passage of the grinding wheel will inevitably result in the truer being struck and possibly tilted. The actual height of the diamond is, of course, governed by the depth of the hole bored through the boss and the length of the piece of bar in which the diamond is seated, but this point needs attention during the construction of this base.

While the diamond holder has spent a considerable period in the base, it will eventually require removing for re-setting, and this means that the small hole underneath, emerging at the point of the pyramid, is essential for knock-out purposes. Again, the grubscrew can damage the sides of the holder during the tightening process sufficiently to make dismantling difficult, so the provision of a small recess by which the screw can clamp the detail is a small but useful refinement.

Whether a diamond is assembled at each end of the holder is again a matter of opinion. A diamond set in such a holder is useless as an item for use in production, and a much better policy is to make two holders and so ensure that diamonds are not locked away out of sight and not properly applied.

In one toolroom using this type of accessory, the writer has noted that the surface grinders have numbered each facet distinctly with a steel stamp, and that a different face is used each day by all concerned; a prominent number chalked every day on a wall or cupboard—1 for Monday, 2 for Tuesday, and so on, by one of their personnel, reminds those using the truer which facet to apply for a certain day, and this practice appears to obtain the maximum service from a very useful and easily made accessory with negligible cost to the company concerned.

Tool Company Appointment

Mr. Leonard Baker has been appointed Deputy Managing Director of the Coventry Gauge & Tool Co. Ltd., and will take up his appointment on October 1, 1958. He is a Member of the Institution of Mechanical Engineers, an Associate Member of the Institution of Production Engineers, and a Member of the American Society of Mechanical Engineers.

Diamond Tool Companies' Addresses Change

The Universal Diamond Co Ltd., formerly of Baker Street, W 1, have recently moved to larger and better premises at: 192 Seven Sisters Rd., N 4.

Diagrit Diamond Tools Ltd., formerly of Marden, Tonbridge, Kent, have moved to a new factory at: Station Rd., Staplehurst, Tonbridge, Kent. The design of the factory permits complete control of atmospheric conditions in the furnace and pressing room.

New Aid Suitable for Diamond Industry

An optical inspection aid of new design has been developed by Combined Optical Industries Ltd., of Slough, which will enable efficient visual inspection in industry and commerce without unnecessary fatigue or inconvenience to the user.

Used in the same way as ordinary spectacles, the optical unit is easy and trouble free to wear. There are none of the discomforts that can be caused by the continual use of a watchmakers' loupe when only one eye is used. With the new aid the hands are left free, and the lenses are so shaped that the user may, without moving his head, look above the upper margin with normal vision.

The basic unit is a half-eye spectacle glazed to a 3 piece rimless mounting. A range of standard magnifier lenses is available, but the manufacturers will purpose-build these inspection spectacles to meet particular needs and specifications.

In the September issue of *Industrial Diamond Review*, reference was made to a diamond-point stipple engraving of a girl's head. This work was incorrectly attributed to Laurence Whistler; it was, in fact, the work of Harry Warren Wilson. We regret any inconvenience caused to either Mr. Whistler or Mr. Wilson.

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